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Morton County, North Dakota

National Eutrophication Survey, Corvallis, Oreg

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

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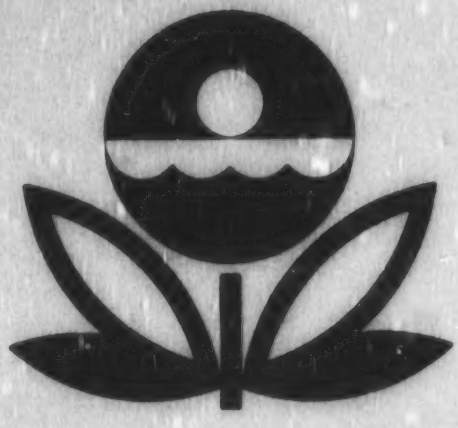

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
SWEET BRIAR LAKE
MORTON COUNTY
NORTH DAKOTA
EPA REGION VIII
WORKING PAPER No. 577

WITH THE COOPERATION OF THE
NORTH DAKOTA STATE DEPARTMENT OF HEALTH
AND THE
NORTH DAKOTA NATIONAL GUARD
OCTOBER, 1976

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the North Dakota State Department of Health for professional involvement, to the North Dakota National Guard for conducting the tributary sampling phase of the Survey, and to those North Dakota wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

Norman L. Peterson, Director, and the staff of the Division of Water Supply and Pollution Control of the Department of Health, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

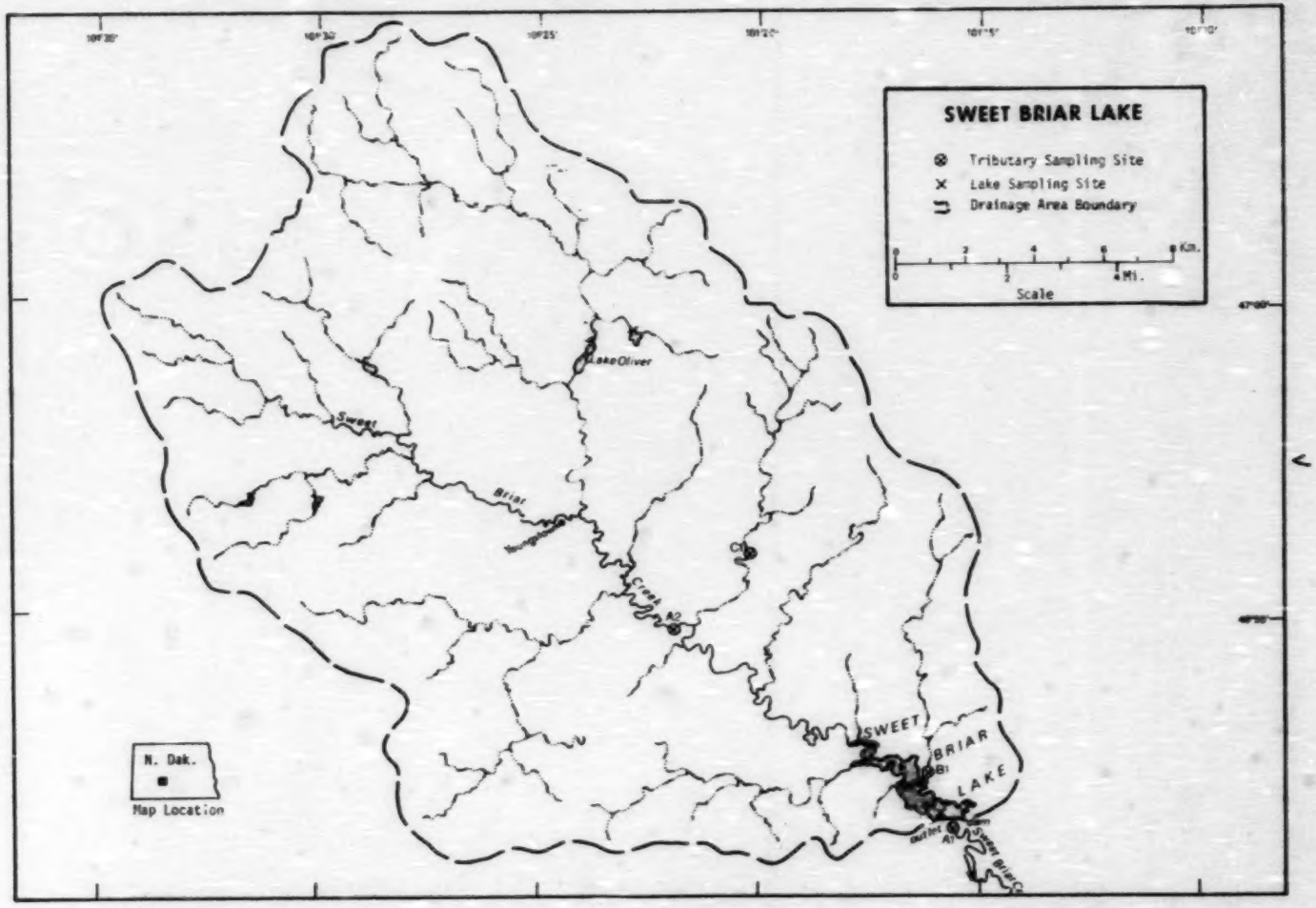
Major General LaClair A. Melhouse, the Adjutant General of North Dakota, and Project Officer Colonel Irvin M. Sande, who directed the volunteer efforts of the North Dakota National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES AND RESERVOIRS

STATE OF NORTH DAKOTA

NAME	COUNTY
Ashtabula	Barnes, Griggs
Audubon	McLean
Brush	McLean
Darling	Renville, Ward
Devils	Benson, Ramsey
Jamestown	Stutsman
LaMoure	LaMoure
Matejcek	Walsh
Metigoshe	Bottineau
Pelican	Bottineau
Sakakawea	Dunn, McKenzie, McLean, Mercer, Mountrail, Williams
Spiritwood	Stutsman
Sweet Briar	Morton
Whitman	Nelson, Walsh


SWEET BRIAR LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
Scale
Lake Oliver
Sweet
Briar
Creek
SWEET
BRIAR
LAKE
N. Dak.
Map Location

SWEET BRIAR LAKE

STORET NO. 3814

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Sweet Briar Lake is eutrophic. It ranked fifth in overall trophic quality when the 14 North Dakota lakes sampled in 1974 were compared using a combination of six water quality parameters*. Five of the lakes had less median total and dissolved phosphorus, two had less median inorganic nitrogen, 11 had less mean chlorophyll a, and six had greater mean Secchi disc transparency.

Survey limnologists noted algal blooms in July at both sampling stations and in September at station 2. The North Dakota Game and Fish Department has reported excessive aquatic vegetation in the lake (Peterson, 1975).

B. Rate-Limiting Nutrient:

The algal assay results indicate that Sweet Briar Lake was limited by nitrogen at the time the sample was collected (09/17/74). The lake data indicate nitrogen limitation at all sampling stations and times.

C. Nutrient Controllability:

1. Point sources--The only point sources which may have contributed to the total phosphorus load during the sampling year

* See Appendix A.

were septic tanks serving lakeshore campgrounds. Those sources were estimated to have contributed 0.5% of the total load; however, a shoreline survey would be needed to determine their nutrient significance.

The present phosphorus loading of 1.71 g/m^2/year is 3.6 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11). Because of the persistent nitrogen-limited condition in the lake, control of phosphorus from septic tanks probably would not result in an improvement in the condition of the lake. Further investigation is needed to determine the contribution and controllability of phosphorus resulting from agricultural practices in the drainage basin (Peterson, 1974).

2. Non-point sources--Non-point sources contributed 99.5% of the total phosphorus load to Sweet Briar Lake during the sampling year. Sweet Briar Creek, the only gaged tributary, contributed 67.6% of the total. The ungaged tributaries and immediate drainage contributed an estimated 30.8%.

The phosphorus export rate of Sweet Briar Creek (page 10) is comparable to the rates of the smaller tributaries of Lake Sakakawea* (2 to 4 $kg/km^2/yr$).

* Working Paper No. 575.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 1.10 kilometers^2.
2. Mean depth: 2.9 meters.
3. Maximum depth: 8.5 meters.
4. Volume: 3.190×10^6 m^3.
5. Mean hydraulic retention time: 183 days (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Sweet Briar Creek	277.1	0.212
Minor tributaries & immediate drainage -	115.5	0.020
Totals	392.6	0.232

2. Outlet -

Sweet Briar Creek	393.7**	0.202

C. Precipitation***:

1. Year of sampling: 51.8 centimeters.
2. Mean annual: 42.3 centimeters.

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† Table of metric conversions--Appendix B.
†† Henegar, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Sweet Briar Lake was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the lake in July and September and one station in April (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 4.6 meters at station 1 and 5.5 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR SWEET BRIAR RESERVOIR
STORET CODE 3814

PARAMETER	1ST SAMPLING (4/30/74) 1 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/16/74) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/17/74) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	11.8 - 11.9	11.9	11.9	23.5 - 24.6	24.2	24.2	14.3 - 15.4	14.7	14.5
DISS OXY (MG/L)	8.6 - 8.8	8.7	8.7	6.2 - 8.6	7.5	7.6	9.6 - 10.8	10.2	10.0
CNDCTVY (MCROMO)	456. - 461.	458.	458.	795. - 800.	798.	798.	570. - 580.	575.	573.
PH (STAND UNITS)	8.1 - 8.3	8.2	8.2	8.8 - 9.0	8.9	8.9	8.9 - 9.1	9.0	9.0
TOT ALK (MG/L)	234. - 252.	242.	240.	272. - 284.	279.	279.	305. - 460.	402.	418.
TOT P (MG/L)	0.061 - 0.076	0.068	0.066	0.090 - 0.168	0.119	0.097	0.079 - 0.622	0.180	0.090
ORTHO P (MG/L)	0.023 - 0.031	0.027	0.028	0.051 - 0.060	0.055	0.055	0.025 - 0.049	0.030	0.027
NO2+NO3 (MG/L)	0.060 - 0.110	0.083	0.080	0.030 - 0.050	0.040	0.040	0.020 - 0.030	0.022	0.020
AMMONIA (MG/L)	0.150 - 0.170	0.160	0.160	0.050 - 0.090	0.065	0.060	0.040 - 0.050	0.043	0.040
KJEL N (MG/L)	1.000 - 1.200	1.133	1.200	1.000 - 2.000	1.300	1.200	1.300 - 3.600	1.833	1.500
INORG N (MG/L)	0.220 - 0.280	0.243	0.230	0.090 - 0.140	0.105	0.095	0.060 - 0.070	0.065	0.065
TOTAL N (MG/L)	1.060 - 1.310	1.217	1.280	1.030 - 2.040	1.340	1.240	1.320 - 3.620	1.855	1.525
CHLRPYL A (UG/L)	1.6 - 1.6	1.6	1.6	9.7 - 40.1	24.9	24.9	21.5 - 122.1	71.8	71.8
SECCHI (METERS)	1.4 - 1.4	1.4	1.4	0.9 - 2.1	1.5	1.5	0.9 - 2.1	1.5	1.5

B. Biological characteristics:

1. Phytoplankton* -

Sampling Date	Dominant Genera	Algal Units per ml
07/16/74	1. Aphanizomenon sp.	3,415
	2. Chroomonas sp.	556
	3. Cryptomonas sp.	357
	4. Ankistrodesmus sp.	79
	Total	4,407
09/17/74	1. Aphanizomenon sp.	3,997
	2. Chroomonas sp.	735
	3. Gloeotrichia sp.	92
	4. Schroederia sp.	46
	5. Coelosphaerium sp.	46
	Total	4,916

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/30/74	1	1.6
	2	-
07/16/74	1	9.7
	2	40.1
09/17/74	1	122.1
	2	21.5

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.105	0.442	15.8
0.050 P	0.155	0.442	14.3
0.050 P + 1.0 N	0.155	1.442	34.3
1.0 N	0.105	1.442	33.8

* The April phytoplankton sample was lost in shipment.

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Sweet Briar Lake was high at the time the sample was collected (09/17/74). Also the lack of increase in yield with the addition of phosphorus, until nitrogen was also added, indicates the lake was nitrogen limited at that time. Note that the addition of nitrogen alone resulted in a yield significantly greater than that of the control.

The lake data indicate nitrogen limitation as well; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 9/1 or less at all sampling stations and times, and nitrogen limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the North Dakota National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff month of May when two samples were collected. Sampling was begun in September, 1974, and was completed in August, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the North Dakota District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in $kg/km^2/year$, at station A-2 and multiplying by the ZZ area in km^2.

No known municipal or industrial wastewater treatment plants impacted the lake during the sampling year.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

* See Working Paper No. 175.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Sweet Briar Creek	1,275	67.6
b. Minor tributaries & immediate drainage (non-point load) -	580	30.8
c. Known municipal STP's - None	-	-
d. Septic tanks* -	10	0.5
e. Known industrial - None	-	-
f. Direct precipitation** -	20	1.1
Total	1,885	100.0

2. Outputs -

Lake outlet - Sweet Briar Creek 1,030

3. Net annual P accumulation - 855 kg.

* Estimate based on six lakeshore campgrounds; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Sweet Briar Creek	14,430	61.6
b. Minor tributaries & immediate drainage (non-point load) -	7,390	31.5
c. Known municipal STP's - None	-	-
d. Septic tanks* -	420	1.8
e. Known industrial - None	-	-
f. Direct precipitation** -	1,190	5.1
Total	23,430	100.0

2. Outputs -

Lake outlet - Sweet Briar Creek 12,265

3. Net annual N accumulation - 11,165 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Sweet Briar Creek	5	64

E. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Unnamed Creek B-1	0.457	4.470
Unnamed Creek C-1	0.315	2.817

* Estimate based on six lakeshore campgrounds; see Working Paper No. 175.
** See Working Paper No. 175.

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	1.71	0.78	21.3	10.2

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Sweet Briar Lake:

"Dangerous" (eutrophic loading)	0.48
"Permissible" (oligotrophic loading)	0.24

V. LITERATURE REVIEWED

Henegar, Dale, 1975. Personal communication (lake morphometry). ND Game & Fish Dept., Bismarck.

Peterson, Norman L., 1974. Personal communication (drainage basin characteristics). ND Dept. of Health, Bismarck.

_____, 1975. Personal communication (North Dakota lake rankings). ND Dept. of Health, Bismarck.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3801	LAKE ASHTABULA	0.260	0.160	472.250	40.892	10.600	0.170
3802	LAKE AUDUBON	0.087	0.220	446.222	11.322	11.000	0.015
3803	BRUSH LAKE	0.066	0.095	449.143	29.114	9.000	0.010
3804	LAKE DARLING	0.274	0.250	466.750	60.075	11.600	0.180
3805	DEVILS LAKE	0.630	0.140	449.333	38.508	14.600	0.469
3806	JAMESTOWN RESERVOIR	0.144	0.365	438.667	19.400	8.800	0.078
3807	LAKE LA MOURE	0.438	0.380	421.400	19.720	15.000	0.290
3808	MATEJCEK LAKE	0.228	0.440	475.167	2.683	14.400	0.179
3809	LAKE METIGOSHE	0.032	0.080	389.167	10.367	9.000	0.010
3811	PELICAN LAKE	0.034	0.070	364.500	10.950	12.800	0.006
3812	LAKE SAKAKAWEA (GARRISON	0.016	0.150	406.733	6.883	10.800	0.007
3813	SPIRIT WOOD LAKE	0.156	0.290	417.833	34.667	15.000	0.082
3814	SWEET BRIAR RESERVOIR	0.092	0.090	440.800	39.000	8.800	0.031
3815	WHITMAN LAKE	0.260	0.260	478.333	27.067	9.200	0.185

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3801	LAKE ASHTABULA	27 (3)	54 (7)	15 (2)	8 (1)	62 (8)	38 (5)	204
3802	LAKE AUDUBON	69 (9)	46 (6)	46 (6)	69 (9)	46 (6)	69 (9)	345
3803	BRUSH LAKE	77 (10)	77 (10)	38 (5)	38 (5)	81 (10)	81 (10)	392
3804	LAKE DARLING	15 (2)	38 (5)	23 (3)	0 (0)	38 (5)	23 (3)	137
3805	DEVILS LAKE	0 (0)	69 (9)	31 (4)	23 (3)	15 (2)	0 (0)	138
3806	JAMESTOWN RESERVOIR	54 (7)	15 (2)	62 (8)	62 (8)	96 (12)	54 (7)	343
3807	LAKE LA MOURE	8 (1)	8 (1)	69 (9)	54 (7)	4 (0)	8 (1)	151
3808	MATEJCEK LAKE	38 (5)	0 (0)	8 (1)	100 (13)	23 (3)	31 (4)	200
3809	LAKE METIGOSHE	92 (12)	92 (12)	92 (12)	85 (11)	81 (10)	81 (10)	523
3811	PELICAN LAKE	85 (11)	100 (13)	100 (13)	77 (10)	31 (4)	100 (13)	493
3812	LAKE SAKAKAWEA (GARRISON	100 (13)	62 (8)	85 (11)	92 (12)	54 (7)	92 (12)	485
3813	SPIRIT WOOD LAKE	46 (6)	23 (3)	77 (10)	31 (4)	4 (0)	46 (6)	227
3814	SWEET BRIAR RESERVOIR	62 (8)	85 (11)	54 (7)	15 (2)	96 (12)	62 (8)	374
3815	WHITMAN LAKE	27 (3)	31 (4)	0 (0)	46 (6)	69 (9)	15 (2)	188

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO.
1	3809	LAKE METIGOSHE	523
2	3811	PELICAN LAKE	493
3	3812	LAKE SAKAKAWEA (GARRISON	485
4	3803	BRUSH LAKE	392
5	3814	SWEET BRIAR RESERVOIR	374
6	3802	LAKE AUDUBON	345
7	3806	JAMESTOWN RESERVOIR	343
8	3813	SPIRIT WOOD LAKE	227
9	3801	LAKE ASHTABULA	204
10	3808	MATEJCEK LAKE	200
11	3815	WHITMAN LAKE	188
12	3807	LAKE LA MOURE	151
13	3805	DEVILS LAKE	138
14	3804	LAKE DARLING	137

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APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NORTH DAKOTA 03/16/76

LAKE CODE 3814 SWEET BRIAR LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 393.7

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3814A1	393.7	0.003	0.028	0.991	0.850	0.255	0.170	0.057	0.028	0.017	0.006	0.006	0.006	0.202
3814A2	277.1	0.000	0.037	0.991	0.850	0.283	0.198	0.085	0.028	0.020	0.011	0.017	0.011	0.212
3814ZZ	41.4	0.0	0.0	0.028	0.113	0.042	0.023	0.017	0.006	0.003	0.003	0.003	0.003	0.020

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 393.7
SUM OF SUB-DRAINAGE AREAS = 318.6

TOTAL FLOW IN = 2.78
TOTAL FLOW OUT = 2.42

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3814A1	9	74	0.006	22	0.005				
	10	74	0.007	20	0.007				
	11	74	0.008	17	0.007				
	12	74	0.006	21	0.006				
	1	75	0.005	18	0.006				
	2	75	0.005	22	0.006				
	3	75	0.008	22	0.006				
	4	75	5.097	5	0.006				
	5	75	0.934	2	0.008	18	16.990		
	6	75	0.396	20	1.189	16	0.793		
	7	75	0.011	18	0.255				
	8	75	0.005	22	0.020				
3814A2	9	74	0.0	22	0.004				
	10	74	0.0	20	0.0				
	11	74	0.0	17	0.0				
	12	74	0.0	21	0.0				
	1	75	0.0	18	0.0				
	2	75	0.0	22	0.0				
	3	75	0.0	22	0.0				
	4	75	3.710	5	0.0				
	5	75	0.566	2	0.0	18	11.893		
	6	75	0.368	20	0.396	16	0.396		
	7	75	0.010	18	0.156				
	8	75	0.0	22	0.003				
3814ZZ	9	74	0.0		0.0				
	10	74	0.0						
	11	74	0.0						
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.0						
	4	75	1.586						
	5	75	0.227						
	6	75	0.159						
	7	75	0.004						
	8	75	0.0						

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APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/03/16

381401
46 51 52.0 101 15 36.0 3
SWEET BRIAR RESERVOIR
38059 NORTH DAKOTA

11EPALES 2111202
0015 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/30	16 35	0000	11.9		57	461	8.25	252	0.150	1.200	0.080	0.023
	16 35	0005	11.9	8.8		458	8.20	240	0.160	1.000	0.060	0.031
	16 35	0015	11.8	8.6		456	8.10	234	0.170	1.200	0.110	0.028
74/07/16	13 20	0000	24.0	7.2	84	798	8.80	284	0.080	1.400	0.040	0.055
	13 20	0005	24.0	6.2		795	8.80	280	0.060	1.000	0.030	0.056
	13 20	0015	23.5	6.6		795	8.80	278	0.090	1.000	0.050	0.060
74/09/17	15 10	0000	15.4	10.8	36	580	9.07	460	0.040	3.600	0.020K	0.049
	15 10	0005	14.8	10.6		579	9.01	425	0.050	1.700	0.020K	0.025
	15 10	0012	14.6	9.6		574	8.95	410	0.050	1.300	0.020K	0.028

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/04/30	16 35	0000	0.061	1.6	
	16 35	0005	0.066		
	16 35	0015	0.076		
74/07/16	13 20	0000	0.095	9.7	
	13 20	0005	0.090		
	13 20	0015	0.096		
74/09/17	15 10	0000	0.622	122.1	
	15 10	0003			1.0
	15 10	0005	0.089		
	15 10	0012	0.079		

K VALUE KNOWN TO BE
LESS THAN INDICATED

ET RETRIEVAL DATE 76/03/16

381402
46 52 24.0 101 16 09.0 3
SWEET BRIAR RESERVOIR
38059 NORTH DAKOTA

11EPALES 2111202
0022 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO26NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/07/16	13 45	0000	24.6	8.2	35	800	9.00	280	0.060	2.000	0.040	0.059
	13 45	0005	24.4	8.6		799	9.00	278	0.050	1.200	0.040	0.052
	13 45	0018	24.4	8.0		798	9.00	272	0.050	1.200	0.040	0.051
74/09/17	15 05	0000	14.5		84	572	9.02	305	0.040	1.500	0.030	0.025
	15 05	0005	14.5	10.0		572	8.96	380	0.040	1.500	0.020	0.029
	15 05	0010	14.3	10.0		570	8.94	430	0.040	1.400	0.020K	0.027

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/07/16	13 45	0000	0.165	40.1	
	13 45	0005	0.168		
	13 45	0018	0.099		
74/09/17	15 05	0000	0.114	21.5	
	15 05	0005	0.092		
	15 05	0010	0.083		1.0

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/03/18

3814A1
46 51 49.0 101 1s 35.0 4
SWEET BRIAR CREEK
38093 7.5 JUDSON
O/SWEET BRIAR LAKE
BRDG ON US RT 10 3.2 MI SE OF JUDSON
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/09/22	09 50		0.004	0.800	0.010	0.010	0.050
74/10/20	09 55		0.024	0.900	0.045	0.015	0.050
75/03/22	08 50		0.115	1.000	0.140	0.025	0.025
75/04/18	08 10		0.280	1.000	0.230	0.060	0.090
75/05/02	08 22		0.500	2.200	0.260	0.065	0.400
75/05/16	08 23		0.510	2.500	0.410	0.080	0.180
75/06/20	08 15		0.540	1.500	0.135	0.050	0.140
75/07/18	08 25		0.130	1.650	0.090	0.020	0.120
75/08/22	08 20		0.055	1.050	0.080	0.025	0.110

STORET RETRIEVAL DATE 76/03/18

3814A2
46 54 45.0 101 23 52.0 4
SWEET BRIAR CREEK
38 7.5 NEW SALEM NE
T/SWEET BRIAR LAKE
DIRT RD BRDG 8.0 MI NW OF JUDSON
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/09/22	09 00		0.006	1.300	0.005K	0.010	0.050
74/10/20	08 20		0.032	1.000	0.025	0.010	0.045
74/11/17	08 40		0.008	0.800	0.025	0.020	0.040
75/03/22	08 20		0.165	1.550	0.200	0.005	0.010
75/04/18	08 45		1.250	2.100	0.410	0.105	0.170
75/05/02	08 47		0.510	1.300	0.185	0.080	0.180
75/05/16	08 45		0.280	2.100	0.110	0.080	0.320
75/06/20	08 40		0.040	1.650	0.040	0.035	0.150
75/07/18	08 40		0.015	0.950	0.050	0.015	0.060
75/08/22	08 40		0.010	0.900	0.015	0.050	0.070

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/18

381401
46 52 35.0 101 53 08.0 4
UNNAMED CREEK
38 7.5 NE# SALEM NE
T/SWEET BRIAR LAKE
BRDG ON SEC RD 4.2 MI N OF JUDSON
11EMALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/04/12	08 30		1.200	3.400	0.790	0.250	0.460
75/05/02	08 35		1.880	2.700	0.740	0.210	0.400
75/05/16	08 35		0.400	3.300	0.060	0.065	0.170
75/06/20	08 30		0.400	4.600	0.230	0.225	0.800

RETRIEVAL DATE 76/03/18

381401
46 56 00.0 101 20 15.0 4
UNNAMED CREEK
38 7.5 NE# SALEM NE
T/S#EET BRIAR LAKE
BRDG ON SEC RD 5.7 M N OF JCT I94/US 10
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/05/02	09 00		0.605	1.900	0.067	0.070	0.210
75/05/16	09 00		0.030	3.100	0.085	0.125	0.420

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